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(54) INTERLOCKING STRUCTURAL REINFORCEMENT SYSTEM

(57) The system comprises prism-shaped parts (2) having a smaller length than the beam (1a, 1b) or post (1c) to be formed, having at their facing ends identical configurations for joining them together, said facing ends comprising: - a lateral undercut (3) defined by a rear plane (5) which forms a first acute angle (a) with a longitudinal plane, perpendicular to the bottom of the lateral undercut (3), and a second acute angle (b) with the plane corresponding to the bottom of the undercut (3) and - a projecting lug (4) which has a configuration matching that of the said undercut (3), the lugs (4) and undercuts (3) of the prism-shaped parts (2) defining in the mutually engaged position two locking zones or wedges in two transverse directions.

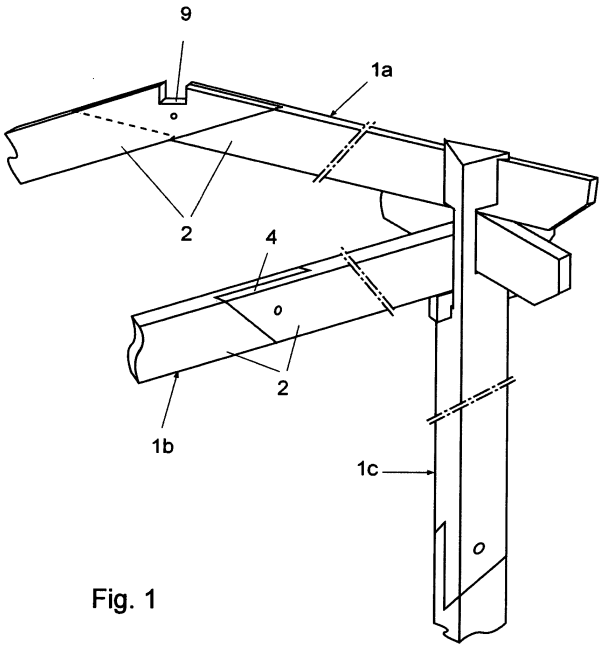

Fig. 1

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Description

Object of the invention

[0001] This invention refers to an interlocking structural reinforcement system applicable to structure construction based on beams and columns formed by prism-shaped elements made of wood, plastic, resin or other similar materials.

Background to the invention

[0002] Various types of structures formed by wooden columns and beams are currently known that are joined mutually using accessory elements, such as metal squares and billets, pins, nails or screws, in certain cases combined with interlocking methods using the actual beam and column elements.

[0003] One example of this type of structure is described in invention patent ES 2 632 348 B1, which refers to a pergola made up of a structure comprising columns with twp pass-through orifices at their upper ends and centred between parallel faces, which enable them to house trusses that present various rectangular indentations along their upper and lower edges in a complementary manner that permits the coupling of both trusses within the column orifices in collaboration with safety pins assisted by a pair of chocks-pins to block said elements when in position.

[0004] In the mentioned patent, just like other wooden structures, the roof structure has a flat configuration that allows significant simplification of the truss assembly, however, when a roof structure is to be constructed with two or more sides, the structure is significantly complicated, especially with respect to the ridgepiece beams arranged in alignment with the ridges or convergence zone of the surfaces corresponding to the various roof sides, making it necessary, in certain cases, to employ central columns to support the upper edges of said ridgepiece beams, with said columns causing interference during the use of the pergola or construction and, in other cases to use lower horizontal trusses to support the ridgepiece beams via vertical supports, which practically doubles the number of beams required to use the roof.

[0005] Moreover, it should be pointed out that that these structures are currently marketed as dismantled kits so that the user is able to assemble them with a certain amount of ease by following the assembly instructions, without having to seek the services of an installer or specialised carpenter.

[0006] However, marketing in a kit involves certain problems due to the need for various structural elements to have limited length in order to facilitate handling, storage and subsequent transport, with it being recommended that the structural elements be shorter than the structural element (beam or column) to be constructed.

[0007] In compliance with these provisions, an additional problem arises regarding providing these elements intended to form beams or columns with simple, economic joints that are easy to assemble and, at the same time, guarantee joint rigidity that is not simultaneously achieved with current joints using metal plates and bolts.

Disclosure of the invention

[0008] The interlocking structural reinforcement system covered by this invention involves certain constructive particularities intended to allow the interlocking and reinforcement of end-facing prism-shaped elements to form columns and beams that are longer than said prism-shaped elements and to obtain easily assembled joints and achieve strengths that are similar to that of any other obtained beam or column section.

[0009] The mentioned structural reinforcement system also allows the establishment of a coaxial or angled joint of the prism-shaped elements to respectively form straight beams or columns or ridgepiece beams that define angles between them, with the joint in the latter case also providing strengths that enable the construction of roof structures without central support columns.

[0010] To this end and in accordance with the invention, this system comprises prism-shaped elements that are shorter than the corresponding beam or column, with identical configurations at facing ends for coupling purposes, with said facing faces comprising: - a lateral recess affecting half the prism-shaped element thickness that is delimited by a rear plane that forms a first acute angle (a) with a longitudinal plane that is perpendicular to the bottom of the lateral recess and a second acute angle (b) with the plane corresponding to the recess bottom, - a protruding appendix corresponding to the other half of the prism-shaped element thickness and which presents a complementary configuration to that of the mentioned recess; with the prism-shaped element appendices and recesses, in the mutual coupling position, forming two wedges or blocking zones in two transversal directions with respect to the prism-shaped element and mutually perpendicular. The end configuration of the prism-shaped elements produces a simple quick coupling, without any anchor plates or bolts.

[0011] The inclination of the rear surface of the lateral recesses with respect to a longitudinal plane and the recess bottom and the complementary configuration of the protruding appendix determines that when the coupling is subjected to compression or bending forces, the protruding appendices exert pressure against the surface of the recess of the other prism-shaped element and they tend to approach each other laterally among the full joint section.

[0012] In one embodiment of the invention, the lateral recesses of the prism-shaped elements present an isosceles trapezoid configuration and the protruding appendices present a longitudinal bevelling at their inclined edges that defines on said appendices, a configuration complementary to that of the cavity delimited by the bottom and the rear plane of the recess; thus the prism-

shaped elements are arranged in the coupling position, mutually faced and longitudinally aligned, forming a straight beam or a column.

[0013] In an embodiment variation, the lateral recesses of the prism-shaped elements present a rhomboidal configuration and the protruding appendices on the longitudinal lateral that is largely protruding, has bevelling that defines, on said appendices, a configuration that is complementary to that of the cavity delimited by the bottom and the rear plane of the recess. In the coupling position, the prism-shaped elements form ridgepiece beams that mutually define an inverted "V" - shaped angle.

[0014] In the two previous embodiments, the protruding appendices in the central zone present at least one transversal orifice for the insertion of a retaining pin in the longitudinal direction of the prism-shaped elements in the coupling position. The purpose of this pin is to prevent the prism-shaped elements coupled by the facing ends from displacing longitudinally when subjected to traction forces, since this separation would cause coupling release.

[0015] In one invention embodiment, corresponding to the mid transversal plane of the previously described joints, the prism-shaped elements present grooving for half-box coupling of a part with complementary grooving for lateral retraining of the protruding appendices in the coupling position and the forming of a crossing of beams or structural elements.

[0016] The facing lateral surfaces of the previously mentioned prism-shaped elements and the lateral retaining part present longitudinal recesses that define a cavity for a retaining pin in the cavity coupling direction.

[0017] According to the invention, the parts forming the columns present vertically connected transversal cavities in their upper ends for through assembly of inclined ridgepiece beams, horizontal trusses and at least one wedge for vertical compression for retention in the assembly position.

Description of the figures

[0018] In order to complete this description and facilitate the understanding of the invention's characteristics, this descriptive report is accompanied by a set of drawings for non-limiting guideline purposes that represent the following:

- Figure 1 shows a partial perspective view of a structure employing the interlocking structural reinforcement system that is the object of this invention.
- Figure 2 is an elevation view of an embodiment example of the reinforcement system of two prism-shaped elements fitted with recesses and isosceles trapezoid prominences that are coupled mutually forming a straight beam.
- Figure 3 corresponds to a plan view of the previous figure.
- Figure 4 is an exploded view of the prism-shaped elements of the previous figure.
- Figures 5 and 6 show elevation and plan views of any one of the - shaped elements of the previous figures in which the end recess and appendix can be appreciated forming the interlocking means.
- Figure 7 is an elevation view of the reinforcement system of Figure 1, with a lateral retaining part, with complementary grooving to that of the longitudinal parts, secured in the assembled position by a retaining pin inserted in longitudinal recesses defined in the facing lateral surfaces of the prism-shaped elements and said lateral retaining part.
- Figure 8 shows a profile view of the previous figure in which the prism-shaped elements are sectioned along a transverse plane.
- Figure 9 is a perspective view of two straight beams similar to that of Figure 1, perpendicularly coupled mutually by the grooving defined in the joint zones of the respective prism-shaped elements.
- Figure 10 is an exploded view of the two straight beams of the previous figure with the facing coupling grooving.
- Figure 11 shows an elevation view of an embodiment variation of the reinforcement system of two prism-shaped elements with recesses and prominences, in this case rhomboidal, coupled mutually forming an angled ridgepiece beam.
- Figure 12 shows a perspective view of the uncoupled prism-shaped elements of Figure 10
- Figure 13 is an elevation view of the uncoupled prism-shaped elements of Figures 11 and 12.
- Figure 14 shows a plan view of any one of the prism-shaped elements of Figure 12.
- Figure 15 is a detailed exploded perspective view of the structure shown in Figure 1, with the beams and the retaining wedge, facing each other in the transversal cavities of the column.

Exemplary embodiment of the invention

[0019] Figure 1 shows a partial structure made up of structural elements, such as angled ridgepiece beams (1a) and trusses or straight beams (1b) coupled over a vertical column (1c), using the interlocking structural reinforcement system.

[0020] This system enables the forming of beams and columns (1a, 1b, 1c) using prism-shaped elements (2) of shorter length that have identical configurations at the facing ends for mutual coupling in the facing positions.

[0021] In the embodiment of Figures 2 to 6, the ends of the prism-shaped elements (2) have lateral recesses (3) that affect approximately half of the prism-shaped element (2) thickness, with the other half of the prism-shaped element defining a protruding appendix (4) having a complementary configuration to that of the mentioned recess (3).

[0022] These recesses (3) are delimited by a rear

plane (5) which, as shown in Figure 5 and 6, forms a first acute angle (a) with a longitudinal plane of the prism-shaped element (2) and a second acute angle (b) with the corresponding plane at the bottom of the recess (3).

[0023] In turn, the protruding appendices (4) present a complementary configuration to that of the recess (3) that permits the frontal coupling of the prism-shaped elements (2) as shown in Figures 2 and 3, configuring, in the mutual coupling position, two wedges or blocking zones in the two transverse perpendicular directions between them.

[0024] The inclined ends of the appendices (4) have longitudinal bevels (6) complementary to the cavity defined between the rear plane (5) and the recess bottom (3).

[0025] In the embodiment of Figure 2 to 6, the prism-shaped elements present a transverse orifice (7) in correspondence with the central zone of the appendices for inserting a retaining pin (8) in the longitudinal direction of the prism-shaped elements (2).

[0026] Additionally in this specific embodiment, the prism-shaped elements (2) present grooves (9) in correspondence with the mid transverse plane of the protruding appendices (4) for the assembly of a part (10) with the complementary grooves (11) for lateral retention of the protruding appendices (4) in the coupling position and the formation of a crossing of beams or structural elements as shown in Figures 7 and 8.

[0027] This part (10) may be treated as a continuous beam or one similar to that shown in Figure 2, in other words, obtained by coupling two prism-shaped elements (2) with the corresponding recesses (3) and protruding coupling appendices as seen in Figures 9 and 10.

[0028] In order to secure the cross part (10) with respect to the joint zone of the prism-shaped elements (2) forming a beam, the facing lateral surfaces said elements have complementary longitudinal recesses (11) that define a cavity for inserting a retaining pin (12).

[0029] In the embodiment variation of Figures 11 to 14, the facing ends of the prism-shaped elements intended to form ridgepiece beams have recesses (3) and protruding appendices (4), similar to those previously described, but with a rhomboidal configuration that, in this case, defining the bevelling for the protruding appendices on the most protruding longitudinal lateral of said appendices. This arrangement determines that when the coupling between the appendices and the prism-shaped element recesses is established, said prism-shaped elements define an inverted "V" angle mutually, thus forming a ridgepiece beam as shown Figure 11.

[0030] In this embodiment, the prism-shaped elements (2) also have orifices (7) for inserting a retaining pin (8) in the longitudinal direction and grooves (9) for perpendicular coupling to another ridgepiece beam, in this case with complementary grooves (9) in its lower zone.

[0031] As shown in Figure 15, the trusses or straight beams (1b) and the ridgepiece beams (1a) on column (1c) are executed by inserting the rear ends of said beams into transverse cavities (13) defined on the in the column and vertically connected to establish beam (1a, 1b) fixing when interlocked by vertical recesses (14) by a retention wedge (15).

[0032] When the nature of the invention is sufficiently described, together with an exemplary embodiment, it is stated for the record that the materials, form, size and arrangement of the described elements may be modified provided this does not involve any alteration to the essential characteristics of the invention the claims for which are given below.

Claims

1. Interlocking structural reinforcement system applicable to the construction of structures based on beams (1a, 1b) and columns (1c) formed by prism-shaped elements made of wood, plastic, resin or other similar materials, **characterised in that** it comprises prism-shaped elements (2) that are shorter than the beam (1a, 1b) or column (1c) to be formed, which have identical configurations at facing ends for coupling which comprise said facing ends: - a lateral recess (3) that affects half the thickness of the prism-shaped element (2) and is delimited by a rear plane (5) that forms a first acute angle (a) with a longitudinal plane perpendicular to the bottom of the lateral recess (3) and a second acute angle (b) with the plane corresponding to the recess bottom (3) and, - a protruding appendix (4) corresponding to the other half of the prism-shaped element thickness, which presents a complementary configuration to that of the mentioned recess (3), with the appendices (4) and recesses (3) of the defining prism-shaped elements (2) in the mutual coupling position, defining two wedges or blocking zones in two transverse directions with respect to the prism-shaped elements (2) and also perpendicular mutually.

2. A system according to claim 1 **characterised in that** the lateral recesses (3) of the prism-shaped elements (2) present an isosceles trapezoid configuration, with the protruding appendices (4) presenting a longitudinal bevel (5) and their inclined end that defines, on said appendices (4), a complementary configuration to that of the cavity delimited by the bottom and rear plane (5) of recess (3) and because the prism-shaped element (2) coupling position are arranged mutually facing and longitudinally aligned.

3. A system according to claim 1 **characterised in that** the lateral recesses (3) of the prism-shaped elements (2) present a rhomboidal configuration because the protruding appendices (4) on the longitudinal lateral that is largely protruding, presents a bevel (6) that defines, on said appendices (4), a configuration that is complementary to that of the cavity

delimited by the bottom and the rear plane (5) of the recess and because, in the coupling position, the prism-shaped elements form ridgepiece beams (1a) that mutually define an inverted "V" - shaped angle.

4. A system according to any of the previous claims **characterised in that** the central zone of the protruding appendices (4) present at least one transverse orifice (7) for inserting a retaining pin (8) in the longitudinal direction of the prism-shaped elements (2) in the coupling position.

5. A system according to any of the previous claims **characterised in that** the prism-shaped elements (2) present grooves (9) for half-box coupling of a part (10) with complementary grooves for lateral retention of the protruding appendices (4) in the coupling position and the forming of a crossing of beams or structural elements.

6. A system according to claim 5 **characterised in that** the prism-shaped elements (2) and the lateral retaining part (10) present longitudinal recesses (11) on the facing surfaces for inserting a retaining pin (11) in the coupling position.

7. A system according to any of the previous claims **characterised in that** the upper ends of the parts (2) forming the columns (1 c) have vertically connected transverse cavities (13) for pass-through assembly of ridgepiece beams (1a), straight beams (1v) and at least one retaining wedge (15).

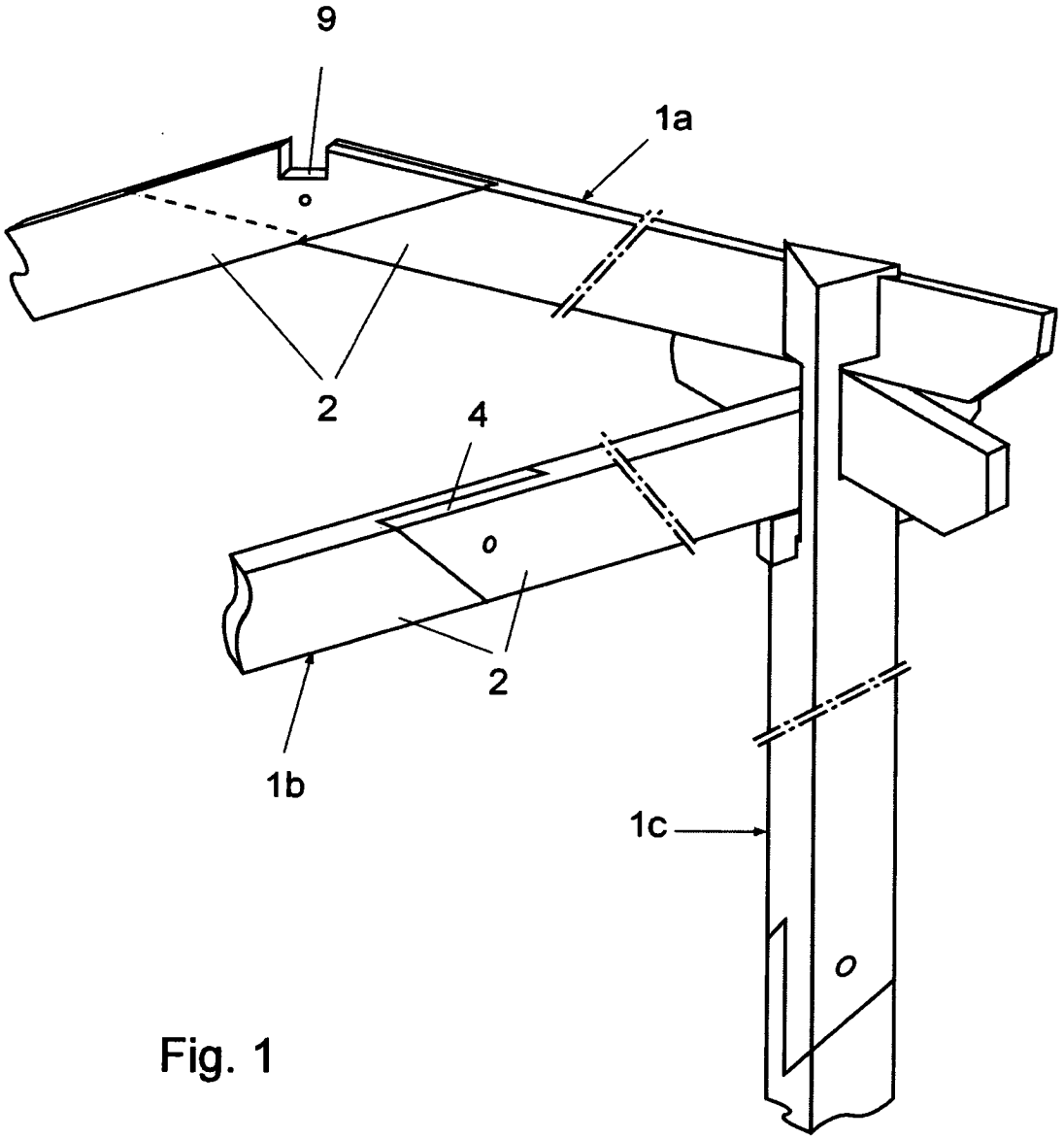

Fig. 1

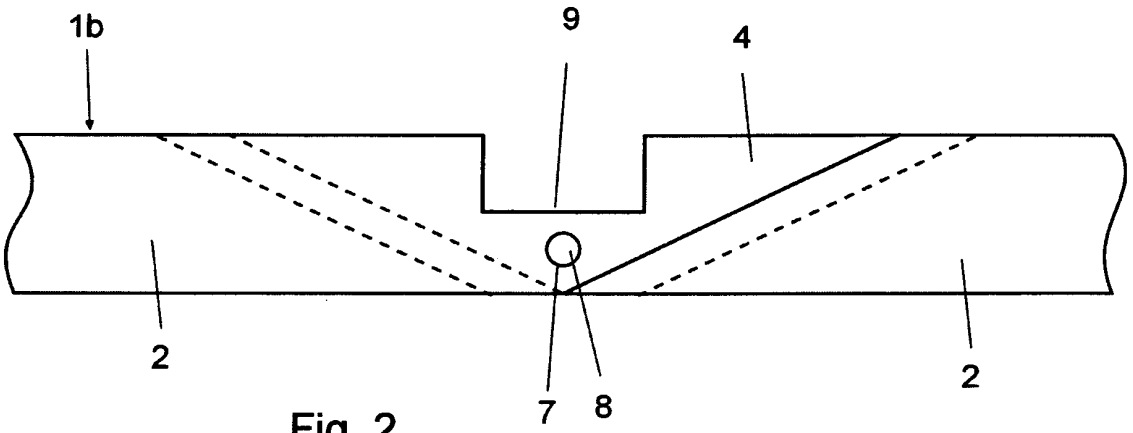

Fig. 2

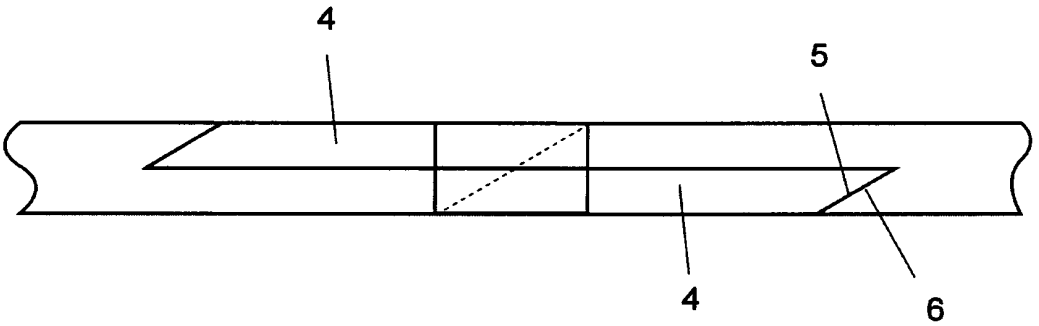

Fig. 3

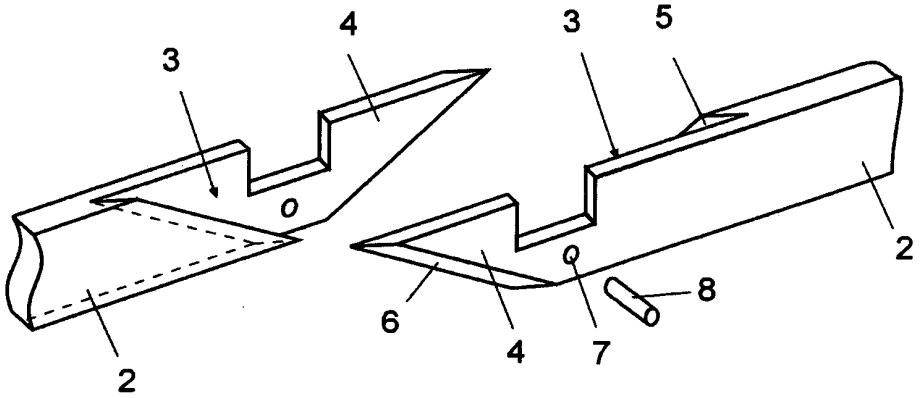

Fig. 4

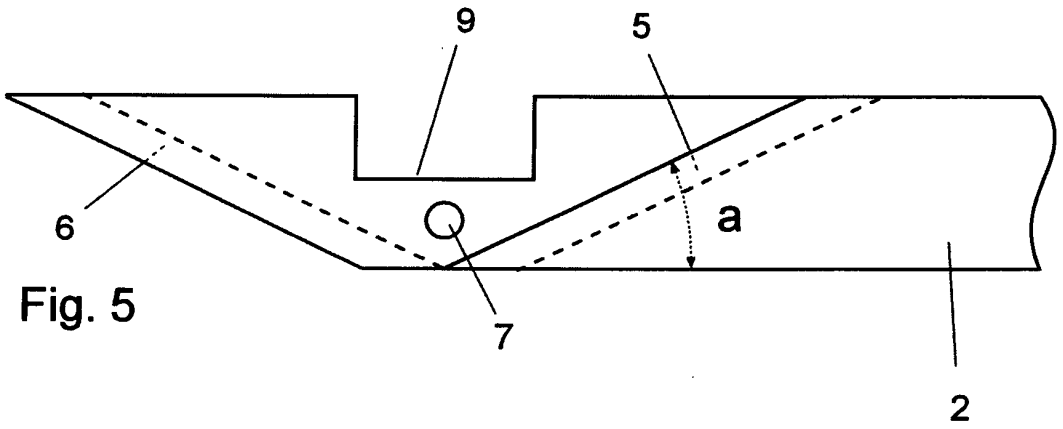

Fig. 5

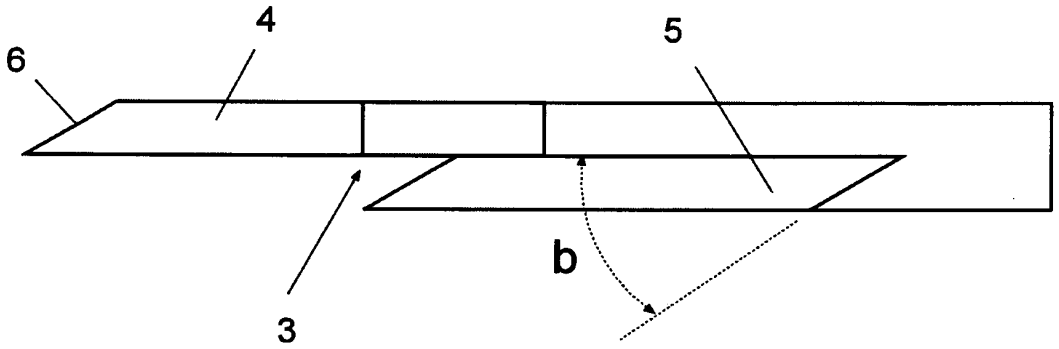

Fig. 6

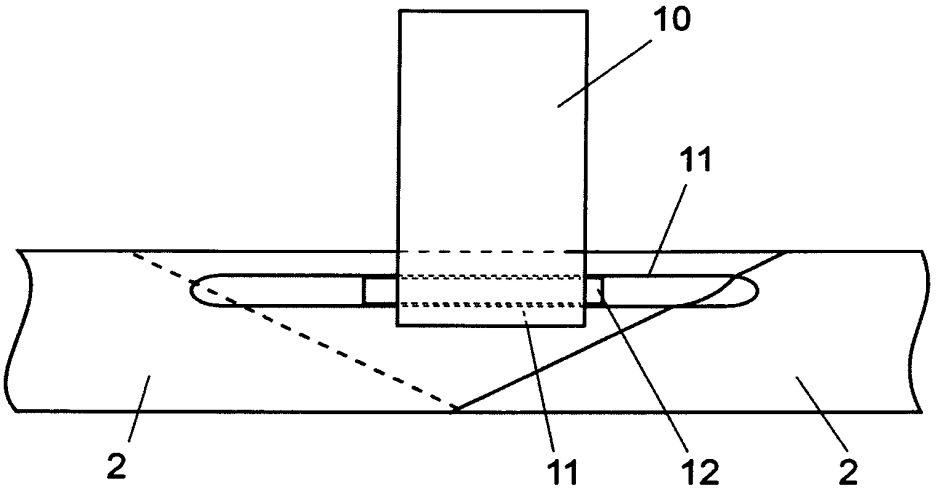

Fig. 7

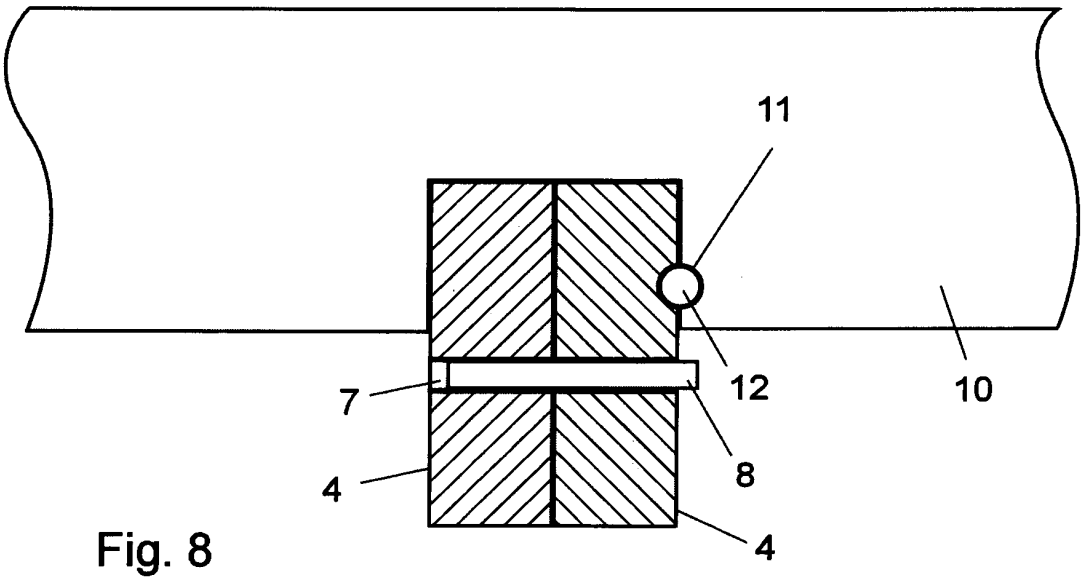

Fig. 8

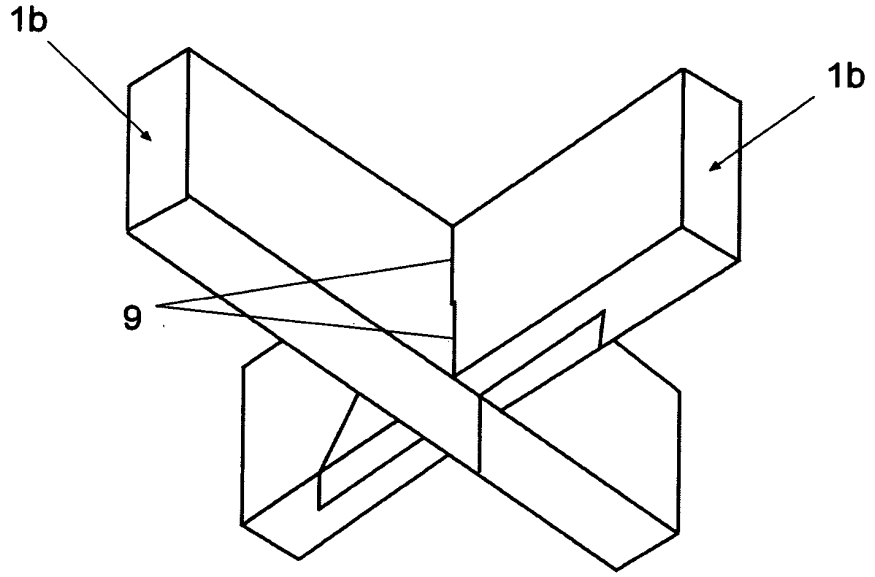

Fig. 9

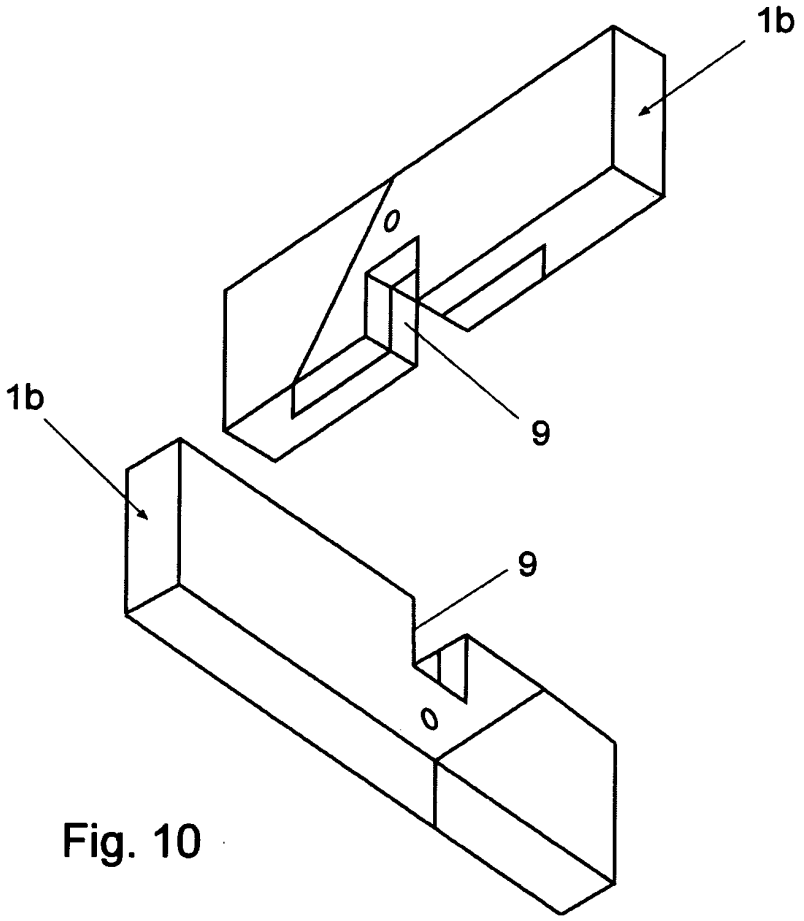

Fig. 10

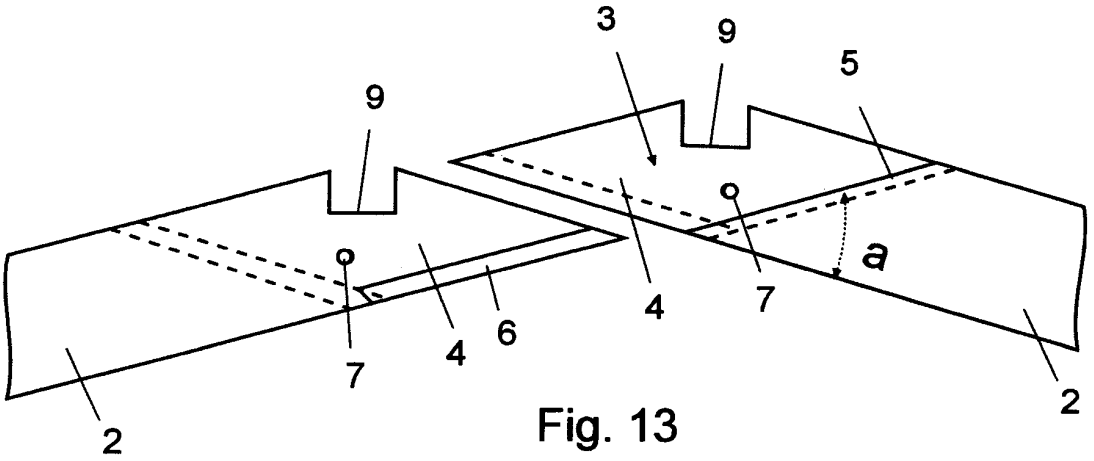

Fig. 13

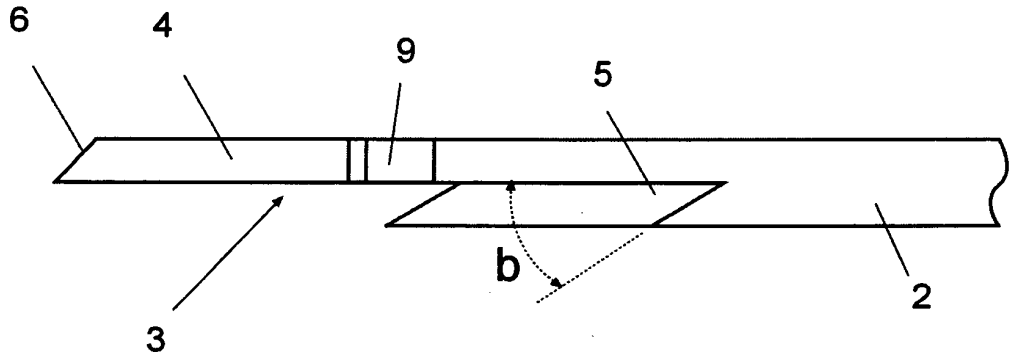

Fig. 14

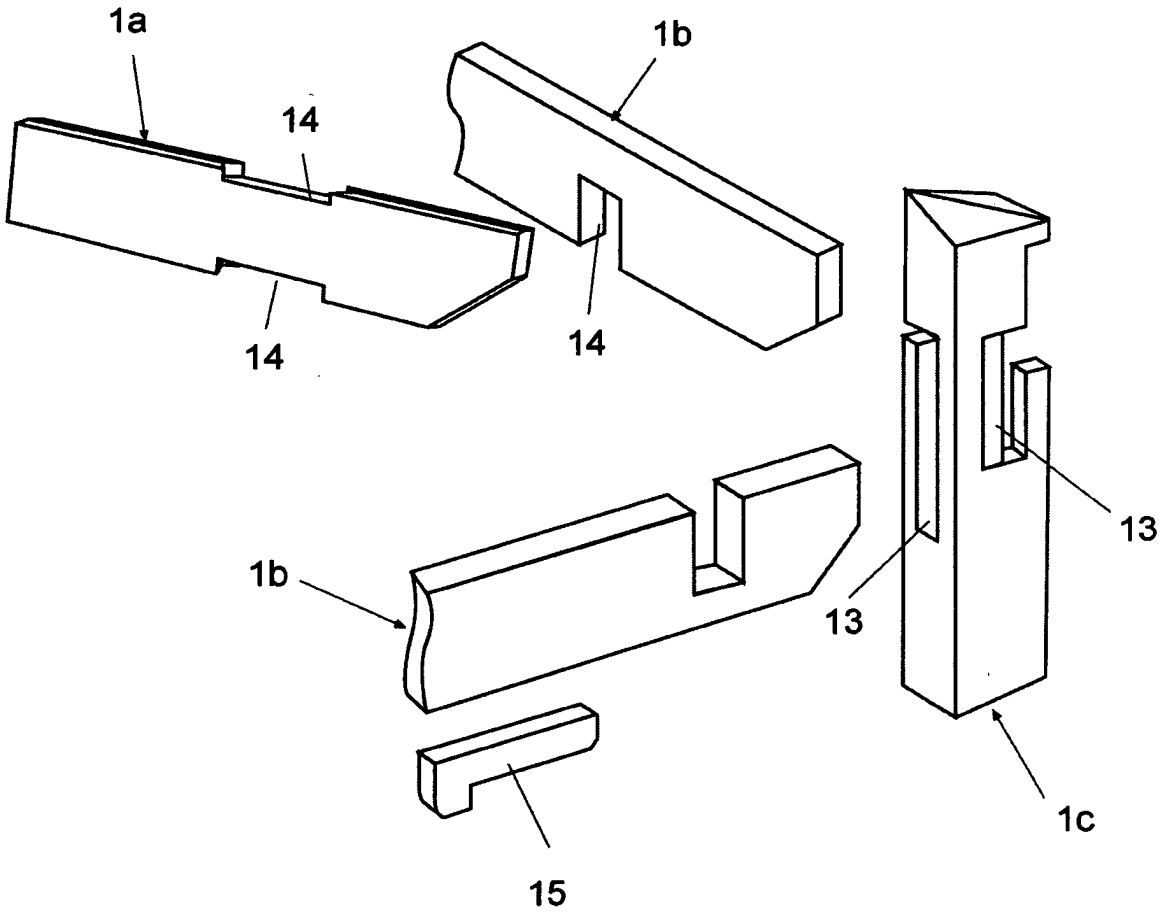

Fig. 15

INTERNATIONAL SEARCH REPORT

International application No.
PCT/ ES 2008/000619

A. CLASSIFICATION OF SUBJECT MATTER

see extra sheet
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
E04B1/26, E04C3/14, E04B1/58, F16B12/12; EC: E04B1/26B, E04C3/14, E04B1/58C1,F16B12/12M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

INVENES,EPODOC,WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	US 4890953 A (MALATESTA) 02.01.1990, abstract; column 2, lines 6-63; figures.	1,2,4 3,5,6,7
Y	ES 2263348 A (MEDIEVAL STYLE,S.L.) 01.12.2006,claims; figures.	5,6,7
Y	US 2005225172 A (BRIGHTWELL) 13.10.2005, figure 11	3
A	US 218920 A (BRAMBLE) 26.08.1879, the whole document	3

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other documents , such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
23.June.2009 (23.06.2009)	**(30/06/2009)**
Name and mailing address of the ISA/ O.E.P.M. Paseo de la Castellana, 75 28071 Madrid, España. Facsimile No. 34 91 3495304	Authorized officer M. Sánchez Robles Telephone No. +34 91 349 54 31

Form PCT/ISA/210 (second sheet) (July 2008)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/ ES 2008/000619

Patent document cited in the search report	Publication date	Patent family member(s)	Publication date
US 4890953 A	02.01.1990	NONE	----------
ES 2263348 A B	01.12.2006	NONE	----------
US 2005225172 A	13.10.2005	CA 2497194 A AU 2005201048 A AU 2005201048 B NZ 538666 A	12.10.2005 27.10.2005 15.06.2006 27.01.2006
US 218920 A	00-00-0000	NONE	----------

Form PCT/ISA/210 (patent family annex) (July 2008)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/ ES 2008/000619

CLASSIFICATION OF SUBJECT MATTER

E04B 1/26 (2006.01)
E04C 3/14 (2006.01)
E04B 1/58 (2006.01)

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- ES 2632348 B1 **[0003]**